

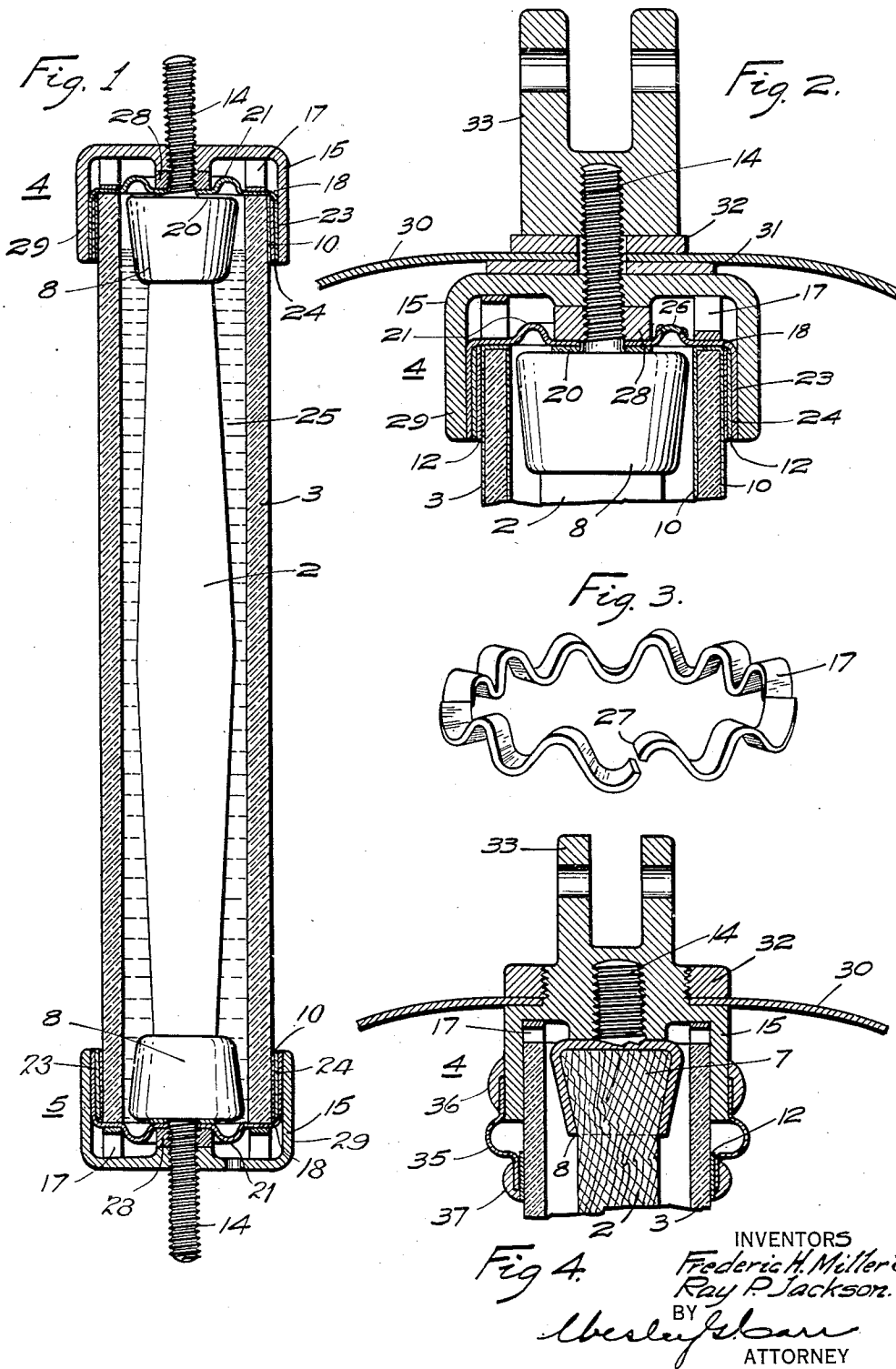
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INSULATOR

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UNITED STATES PATENT OFFICE

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INSULATOR

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Our invention relates to insulators and particularly to insulators for high-voltage transmission-line service.

One object of our invention is to provide an insulator that shall utilize, to substantially maximum advantage, a load-sustaining member of dielectric material that is normally adversely affected by corona and weather.

Another object of our invention is to provide an insulator embodying a fluid-containing casing or receptacle that shall be absolutely fluid tight and that shall remain hermetically sealed over a relatively long period of time without the necessity of renewing or adding to the fluid therein.

Another object of our invention is to provide a composite insulator of organic and inorganic insulating materials that shall be so constructed and related as to ensure an insulator of improved mechanical strength, increased resistance to weather and corona and reduced likelihood of breakage.

A further object of our invention is to provide a high-voltage insulator that shall be simple and durable in construction, economical to manufacture and effective in its operation.

Heretofore, insulators have been proposed which comprised load-sustaining members of organic insulating material, such as wood, paper, cloth and the like, and enclosure members therefor of inorganic material, such as porcelain or glass.

These suggestions were occasioned by the fact that the organic or fibrous materials, while having greater mechanical strength, are more subject to deterioration from corona and weather effects than the inorganic materials.

As above stated, while such proposals have been made, many of them have been incomplete in one way or another. For instance, it is not sufficient merely to enclose an organic dielectric member by an inorganic member. Such an arrangement, while possibly protecting the organic element against the weather, does not protect it against corona effects, unless other precautions are taken. For instance, if a fibrous tension element is placed in a glass tube containing air,

corona will creep along the organic element and ultimately form a conducting path throughout its length. This will be true no matter how closely the tube appears to fit the element. Also, where a sealing or filling medium, such as a rubber compound, is placed between the organic element and the tube, upon cooling, the filling agent shrinks away from the element, leaving air pockets through which corona creeps.

An insulator is known to us which employs oil as a filling or sealing medium around the organic load-sustaining element and utilizes substantially the best available means for sealing and retaining the oil in the tube.

However, with the known propensities of oil to creep through minute crevices, the above-mentioned oil-filled insulator is also provided with an oil-level gauge which, by the aid of binoculars, may be inspected by a lineman from the ground. When the oil reaches a certain low level, it is necessary for the operator to ascend the tower and place more oil in the insulator.

So far as we know, the above-mentioned insulator is successful from both mechanical, and electrical view-points but, by reason of the oil-loss feature and the necessity for refilling, it is not known to us that the device has ever been employed in any except very special application.

It is felt certain that insulators of such character could not, or would not, be extensively employed as commercial substitutes for the present well-known insulators of the series-string suspension type.

It is our aim to provide an insulator that may be so employed and, at the same time, one that shall be so effectually and permanently sealed as to permit the use of oil, dry air, inert gas or other medium as a filling and sealing means for the organic element, without the necessity of frequent inspection and manipulation, as above described. While not so limited, the device of our invention is particularly adapted for use as an element of an insulator set forth in co-pending application, Serial No. 548,818, filed April 1, 1922, by B. H. Smith and assigned to the Westinghouse Electric & Manufacturing Company.

In practicing our invention, we provide an insulator in which organic and inorganic dielectric materials are so arranged and a seal so provided therefor as to utilize both of these materials to substantially the maximum advantage thereof in view of the above-mentioned considerations, and in which the seal embodies unlike materials, such as porcelain and metal, that are fused or integrally united molecularly to each other in a manner heretofore not suggested in a combination and for a purpose similar to ours, so far as we are aware.

Other features, more or less independent of the specific type of seal employed, are included, as will hereinafter appear, which cooperate to render our invention a distinct advance in the field of endeavor to which it relates.

Figure 1, of the accompanying drawing, is a longitudinal side view, partially in elevation and partially in section, of an elongated insulator structure embodying our invention;

Fig. 2 is an enlarged detail view of the upper-end structure of Fig. 1, showing additional elements for cooperation therewith;

Fig. 3 is a detail perspective view of an element shown in the other figures; and

Fig. 4 is a view, similar to Fig. 2, of a modified form of our invention.

Referring more particularly to Fig. 1, the device comprises, in general, a load-sustaining element 2, a tubular enclosing shell or casing 3 therefor and upper and lower terminal structures 4 and 5, respectively.

The load-sustaining element 2 is preferably a tension element in the form of a tube or rod and constructed of organic or fibrous insulating material, such as wood, paper, cloth or other fiber impregnated with a preserving, hardening, sealing or strengthening binder, a preferred form being that of a wood strain rod impregnated with a phenolic condensation product.

The rod 2 may preferably taper from its middle toward its ends and have relatively large substantially frusto-conical ends 7, as indicated more clearly in Fig. 4. This construction provides strength and proper distribution of the load and permits tension terminal elements 8 of the terminal structures 4 and 5 to be swaged or clamped securely in transverse clamping, longitudinal-interlocking relation to the frusto-conical ends 7.

The tubular casing 3, of inorganic material, preferably porcelain, is provided with a silica-glaze coating 10, entirely covering the same, as indicated in Fig. 2, and, on its outer longitudinal surface, near its ends, with metallic-glaze bands 12. Other arrangements of the coatings 10 and 12 are, of course, permissible and contemplated, such as omitting the silica glaze from certain parts of the tube and placing the metallic-glaze 12

on the transverse-end or inner-longitudinal surfaces of the tube 3.

In providing the coatings 12, the initially vitrified and silica-glazed tube 3 is coated with the metallic glaze in a wet state and the tube again subjected to a firing operation, which is at a temperature suitable to fuse the silica glaze, after which it is slowly cooled to room temperature.

The metallic glaze employed is preferably chloro-platinic acid suspended in essential oils, such as lavender cloves and spice, the result being a lustrous silvery metallic surface which is integrally united molecularly to the silica glaze and, through the latter, to the tube and may be electroplated, soldered, welded and otherwise treated or integrally united molecularly to other metals.

The union between the metallic glaze and the tube is so close that, when the metal coating is forcibly torn from the tube, particles of the porcelain are torn off with it. This structure distinguishes from coatings produced by the deposition of the so-called sticky materials, the electrolytic deposition of metals, the spraying of molten metals and other processes, which do not ordinarily produce bonds comparable in strength, durability or fluid and vacuum tightness to the bond herein set forth.

Examples of other compounds or mixtures which may be applied in a manner similar to chloro-platinic acid to obtain the metal-surface bonds 12 are silver nitrate mixed with a reducing agent, such as sugar, silver oxalate, copper acetate, nickel formate, copper formate and any other metal which may be reduced. The terminal structures 4 and 5 further comprise studs 14 on the elements 8, main-supporting caps 15 for the tube 3 on the studs 14, cushioning or spacing means or gaskets 17 and sealing means or end caps 18.

The sealing caps 18, preferably of relatively thin sheet metal, such as copper, are provided with relatively small central openings which closely fit the studs 14 and adjacent to which the caps are integrally united molecularly to the elements 8, as by bodies of solder 20. The caps 18 are provided also with yieldable or flexible annular portions or corrugations 21 between the solder bodies 20 on the tension element 2 and longitudinal cylindrical side wall portions 23 which are integrally united molecularly to the metallic-glaze bands 12, as by bodies of solder 24.

The above construction provides a substantially absolute and permanent hermetic seal for the tube 3 in which a body of oil 25, dry air, inert gas or other insulating medium may be disposed. Oil, the preferred medium, may be introduced into the tube 3, after the latter has been sealed by the caps 18, through a small hole in one of the caps 18, which is afterwards hermetically sealed, as

by a body of solder or a cap 26 soldered in place.

The spacing ring or gasket 17 may be of any suitable character but is shown as a corrugated or annularly-waved metal ring having a split 27, the construction being such as to suitably space and support the porcelain tube 3 in the main supporting caps 15 and to render the tube free of thermal expansion and load stresses. The solder seals 20 and 12 are mechanically reinforced or protected by nuts 28 on the studs 14 and the closely slidably fitting side walls 29 of the caps 15 respectively.

As shown in Fig. 2, the device is adapted to receive an electrostatic-stress-distribution hood or element 30 between washers 31 and 32 and beneath a clevis 33 or other terminal attaching means on the upper stud 14, the clevis 14 being adapted to mount the insulator on a main-supporting tower or pole cross arm and the lower stud being for the reception of a conductor clamp or another insulator or insulators between the lower stud and the conductor.

In the modification of our invention illustrated in Fig. 4, in which corresponding parts are designated by corresponding reference characters, the sealing caps 18 are omitted and the main caps 15 are disposed in adjacent sliding relation to the tube ends.

In this case, the hermetic sealing of the tube is obtained by cylindrical diaphragms or elements 35 that are soldered, as by wiped joints 36 and 37, to the metal caps 15 and to metallic-glaze films on the porcelain tube 3, respectively.

In both forms, the load is transferred between the studs 14 and the element 2, without affecting the tube 3 and its sealing parts and, in the device of Fig. 4, the load is transferred from the extreme outer terminal means 33, or means similar thereto at both ends of the insulator, through the intermediary of the caps 15.

Also, in both forms, there is a complete sealing casing in which all of the parts are integrally united molecularly to preserve the insulating fluid 25 over long periods, without the necessity of inspection or renewal.

Further, in either form, one of the sheet-metal sealing elements 18 and 35 and one of the rings 17, such as those at the lower end of the device, may be omitted and the tube 3 soldered directly to the main cap 15, and the compensation for thermal and load stress obtained as by the retention of these elements at the other end.

While we have shown and described particular forms of our invention, changes may be effected therein without departing from the spirit and scope thereof, as set forth in the appended claims.

We claim as our invention:

1. A suspension insulator comprising an

elongated insulating tension element, a tubular member of inorganic dielectric material surrounding said element and having metallic-glaze bands adjacent to the ends thereof, terminal means secured to the ends of said element and sealing means between the element and the tube soldered to said bands, one of said sealing means being flexible.

2. A suspension insulator comprising a tubular structure, an insulating tension element therein, terminal means secured to said element including an end-cap element for the tube movably related thereto and yieldable sealing means between and secured to the tube and one of said elements.

3. A suspension insulator comprising a tubular structure, an insulating tension element therein, terminal means secured to said element including an end-cap element for the tube movably related thereto, yieldable spacing means between the tube and said cap element and flexible sealing means between the tube and one of said elements.

4. An insulator comprising an inorganic dielectric body having a through opening and metallic-glaze bands about the opening adjacent to the ends thereof, a load-sustaining organic dielectric element in said opening, terminal means secured to the ends of said element and sealing means between the body and the element soldered to said bands, one of said sealing means having a flexible portion.

In testimony whereof, we have hereunto subscribed our names this 9th day of June, 1928.

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